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SAMPLING AND ANALYSIS PLAN AREA OF CONCERN 569 AND 570 AND 578 (AOC569
AND 570 AND 578) ZONE E WITH TRANSMITTAL CNC CHARLESTON SC
2/7/2002
CH2M HILL

AOCs 569, 570, and 578 Zone E

SAMPLING and ANALYSIS PLAN (ROI)



CH2MHILL

February 7, 2002

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Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: Sampling and Analysis Plan for AOCs 569, 570, and 578, Zone E

Dear Mr. Scaturo:

Enclosed please find two copies of the Sampling and Analysis Plan for AOCs 569, 570, and 578, Zone E of the Charleston Naval Complex (CNC). This Sampling Plan has been prepared to complete the RCRA Facility Investigation (RFI) activities and to provide information that can be used to make decisions regarding the need for corrective measures at the site.

The principal author of this document is Sam Naik. Please contact him at (770) 604-9095, extension 255, should you have any questions or comments.

Sincerely,

CH2M HILL



Dean Williamson, P.E.

cc: Tim Frederick/Gannett-Fleming, Inc., w/att
Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

Sampling and Analysis Plan

Areas of Concern 569, 570, and 578, Zone E

**Charleston Naval Complex
North Charleston, SC**

Prepared for
**U.S. Navy Southern Division
Naval Facilities Engineering Command**

Prepared by
CH2M-Jones

February 2002

Contract N62467-99-C-0960

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1 Acronyms and Abbreviations

2	AOC	area of concern
3	BCT	BRAC Cleanup Team
4	BEQ	benzo(a)pyrene equivalent
5	BRAC	Base Realignment and Closure Act
6	BRC	background reference concentration
7	BTEX	benzene, toluene, ethylbenzene, and xylene
8	CNC	Charleston Naval Complex
9	COC	chemical of concern
10	COPC	chemical of potential concern
11	CSAP	Comprehensive Sampling and Analysis Plan
12	DAF	dilution attenuation factor
13	EGIS	Environmental Geographic Information System
14	EnSafe	EnSafe Inc.
15	EPA	U.S. Environmental Protection Agency
16	ft bls	feet below land surface
17	GPS	Global Positioning System
18	MCL	maximum contaminant level
19	mg/kg	milligram per kilogram
20	PAH	polycyclic aromatic hydrocarbon
21	PCE	tetrachloroethene
22	PPE	personal protective equipment
23	RBC	risk-based concentration
24	RCRA	Resource Conservation and Recovery Act
25	RFA	RCRA Facility Assessment
26	RFI	RCRA Facility Investigation
27	SCDHEC	South Carolina Department of Health and Environmental Control
28	SSL	soil screening level
29	SVOC	semivolatile organic compound
30	TDS	total dissolved solids
31	TCE	trichloroethene
32	UST	underground storage tank
33	VOC	volatile organic compound

1.0 Introduction

1.1 Background

Previous investigations in the vicinity of Areas of Concern (AOCs) 569, 570, and 578 in Zone E of the Charleston Naval Complex (CNC) have indicated the presence of some organic and inorganic constituents in soil above their respective chemical of potential concern (COPC) screening criteria. CH2M-Jones has prepared this Sampling and Analysis Plan (SAP) to complete the delineation of these site constituents in the field as part of the RCRA Facility Investigation (RFI) and to provide information that can be used to make decisions regarding the need for corrective measures at this site.

Figure 1-1 illustrates the location of Zone E within the CNC. Figure 1-2 is an aerial photograph of AOCs 569, 570, and 578.

1.2 Organization of the Sampling and Analysis Plan

This SAP consists of the following sections, including this introductory section:

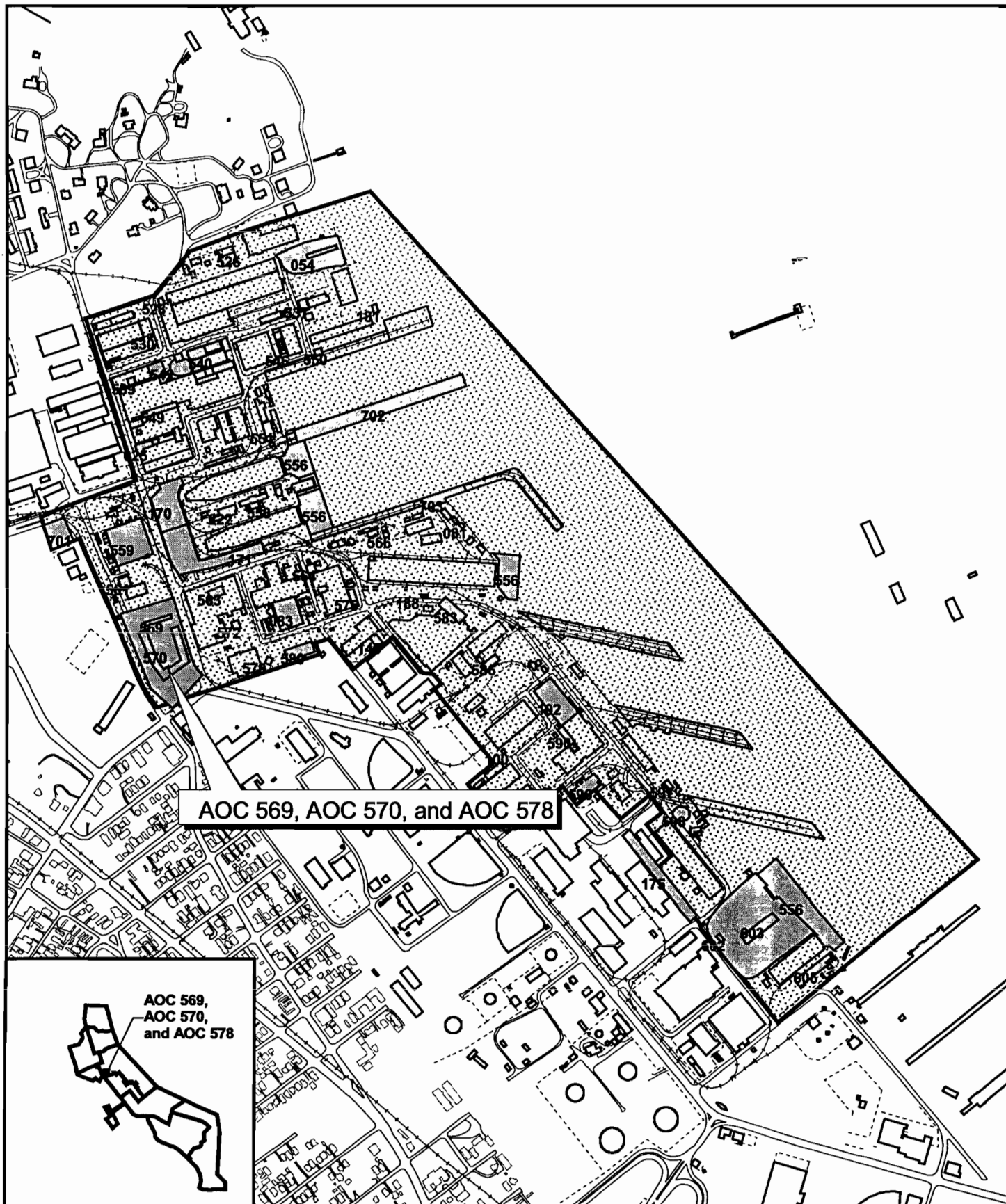
1.0 Introduction – Presents the purpose of the SAP and background information regarding the site.

2.0 Site Background– Provides a brief description of AOCs 569, 570, and 578 and the findings of previous RFI activities.

3.0 Proposed Sampling and Analysis – Describes the investigative approach for delineation of COPCs to complete the RFI.

4.0 References – Lists the references used in this document.

All tables and figures appear at the end of their respective sections.



AOC 569, AOC 570, and AOC 578



-  Zone E Boundary
-  SWMU/AOC Within Zone E Boundary



0 800 1600 Feet

1 inch = 800 feet

Figure 1-1
 Zone E Within CNC
 AOC 569, AOC 570, and AOC 578, Zone E
 Charleston Naval Complex

NOTE: Aerial Photo Date is 1997



Figure 1-2
AOC 569 , 570, and 578
Site Map
Charleston Naval Complex

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2.0 Site Background

2.1 Site Background and Setting

AOC 569 – Former Gas Station and Oil Storage; AOC 570 – Former Coal Storage Area; and AOC 578 – Transportation Shop and Garage

AOC 569 is a former gas station and oil storehouse previously housed in Building 1279 in Zone E of the CNC. The gas station was constructed in 1944 and consisted of two pumps and two 2,500-gallon underground storage tanks (USTs). In 1986, an additional 3,000-gallon UST was installed. During 1992, the site was demolished and the three USTs were removed by the Navy. During the tank closure activities, the tanks were pumped out and removed and the vent lines were filled. Contaminated soil was excavated and confirmatory soil samples were collected from the tank excavation area. The site was then backfilled with soil and resurfaced with asphalt. These activities are documented in a report titled *Investigation of Underground Contamination, Charleston Naval Shipyard – Building 1279* (LandRec, 1992). The AOC 578 area is zoned industrial.

As identified in the RCRA Facility Assessment (RFA) documentation, the materials of concern for AOC 569 include petroleum hydrocarbons; benzene, toluene, ethylbenzene, and xylene (BTEXs); polycyclic aromatic hydrocarbons (PAHs); volatile organic compounds (VOCs); and heavy metals.

AOC 570 is a former coal storage area in Zone E of the CNC. The coal storage facility extended from Building 30 to Sixth Avenue and from Carolina Avenue to Hobson Avenue at the CNC. The coal storage area was operated from 1919 to 1941. The AOC 570 area is zoned industrial. The RFA identified the materials of concern for AOC 570 to be metals.

AOC 578 consists of a transportation shop and garage in Building 25 in Zone E of the CNC. The structure was built in 1940. The structure was originally used as an automobile garage and more recently as a transportation and appliance maintenance shop. Building 25 currently includes various facilities, such as an air-conditioning repair shop, a sheet metal shop, two electric shops, a paint shop, a sign shop, a carpenter's shop, a paper shredding area, an electrical maintenance shop, a tool room, and an emergency supply storage area. The AOC 578 area is zoned industrial.

The RFA identified the materials of concern for AOC 578 to include petroleum hydrocarbons, BTEXs, PAHs, VOCs, acids, and heavy metals.

2.2 RFI Investigation Results

2.2.1 AOCs 569, 570, and 578 RFI Investigation

Soil Investigation

As part of the RFI field investigation, surface soil samples (0 to 1 foot below land surface [ft bls]) and co-located subsurface soil samples (3 to 5 ft bls) were collected in two sampling events. Figure 2-1 shows historic RFI soil sample locations. Samples from the first sampling event were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, and pH. Three samples were selected as duplicates and were analyzed for VOCs and SVOCs, as well as herbicides, organophosphorous pesticides, hexavalent chromium, and dioxins. Samples from the second sampling event were analyzed for SVOCs and metals. One duplicate sample was collected during the second sampling event and analyzed for VOCs and SVOCs, as well as herbicides, organophosphorous pesticides, hexavalent chromium, dioxins, and metals.

RFI activities at this combined site are described in the *Zone E RFI Report, Revision 0* (EnSafe Inc. [EnSafe] 1997).

Surface Soil. During the initial RFI, analytical results from surface soil samples were evaluated against the U.S. Environmental Protection Agency (EPA) Region III risk-based concentrations (RBCs), the Zone E surface soil background reference concentrations (BRCs), and site-specific soil screening levels (SSLs) (with a dilution attenuation factor [DAF] = 10). Based on the analysis presented in the RFI report, benzo(a)pyrene equivalents (BEQs) and arsenic exceeded their screening criteria. BEQs were identified as chemicals of concern (COCs) based on exceedances of the industrial RBC of 0.78 milligrams per kilogram (mg/kg) for benzo(a)pyrene at seven sample locations. Arsenic was identified during the initial RFI as a COC based on exceedance of its residential land use criteria at multiple sample locations. All samples were collected from the 0 to 1-ft bls interval beneath the asphalt cover. Figure 2-3 shows the locations and exceedances of site constituents above screening criteria in surface soils during the initial RFI.

Subsurface Soil. During the initial RFI, analytical results from subsurface soil samples were compared to the EPA Region III unrestricted and industrial RBCs and EPA generic SSLs, using a DAF of 10. Acetone, benzene, carbon tetrachloride, ethylbenzene, and xylene were

1 identified in the RFI report as exceeding their respective SSLs at a single sample location
2 (569SB005). Figure 2-4 shows the locations and exceedances of site constituents of the
3 screening criteria in subsurface soils, during the initial RFI. Based on the risk assessment
4 presented in the RFI Report, no constituents in subsurface soils were identified as COCs.

5 **Groundwater Investigation**

6 Nine monitoring wells (six shallow and three deep) were installed and sampled as part of
7 the RFI investigation (see Figure 2-2 for locations of RFI monitoring well locations). The
8 groundwater samples were analyzed for VOCs, SVOCs, metals, chlorides, sulfates, total
9 dissolved solids (TDS), and pH. Two duplicates (one from a shallow monitoring well and
10 one from a deep monitoring well) were collected and analyzed for VOCs, SVOCs,
11 herbicides, hexavalent chromium, organophosphorus pesticides, and dioxins. Constituents
12 detected in the groundwater samples were evaluated relative to maximum contaminant
13 levels (MCLs). In the absence of an MCL, the EPA Region III tap water RBCs were used.
14 Groundwater was sampled during four sampling events during the RFI (plus two
15 subsequent post-RFI sampling events), but the RFI report focused exclusively on the
16 findings from the first sampling event. Based on the risk assessment presented in the RFI
17 report, aluminum, arsenic, beryllium, chloroform, chromium, lead, tetrachloroethene (PCE),
18 trichloroethene (TCE), thallium, and vanadium were identified as COCs in shallow
19 groundwater. During the initial RFI, thallium, trichloroethene, and 1,2-dichloroethene were
20 identified as COCs for deep groundwater.

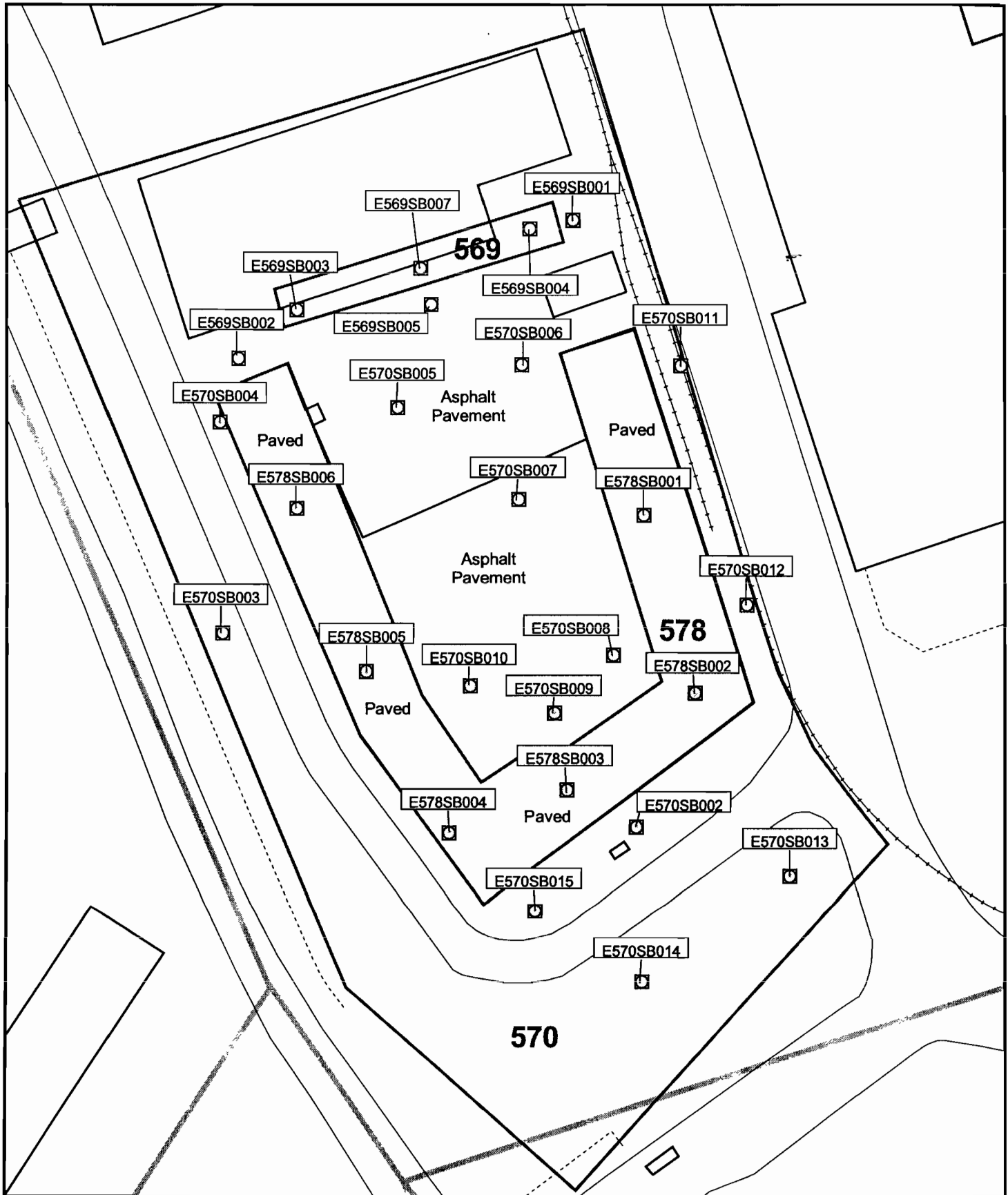
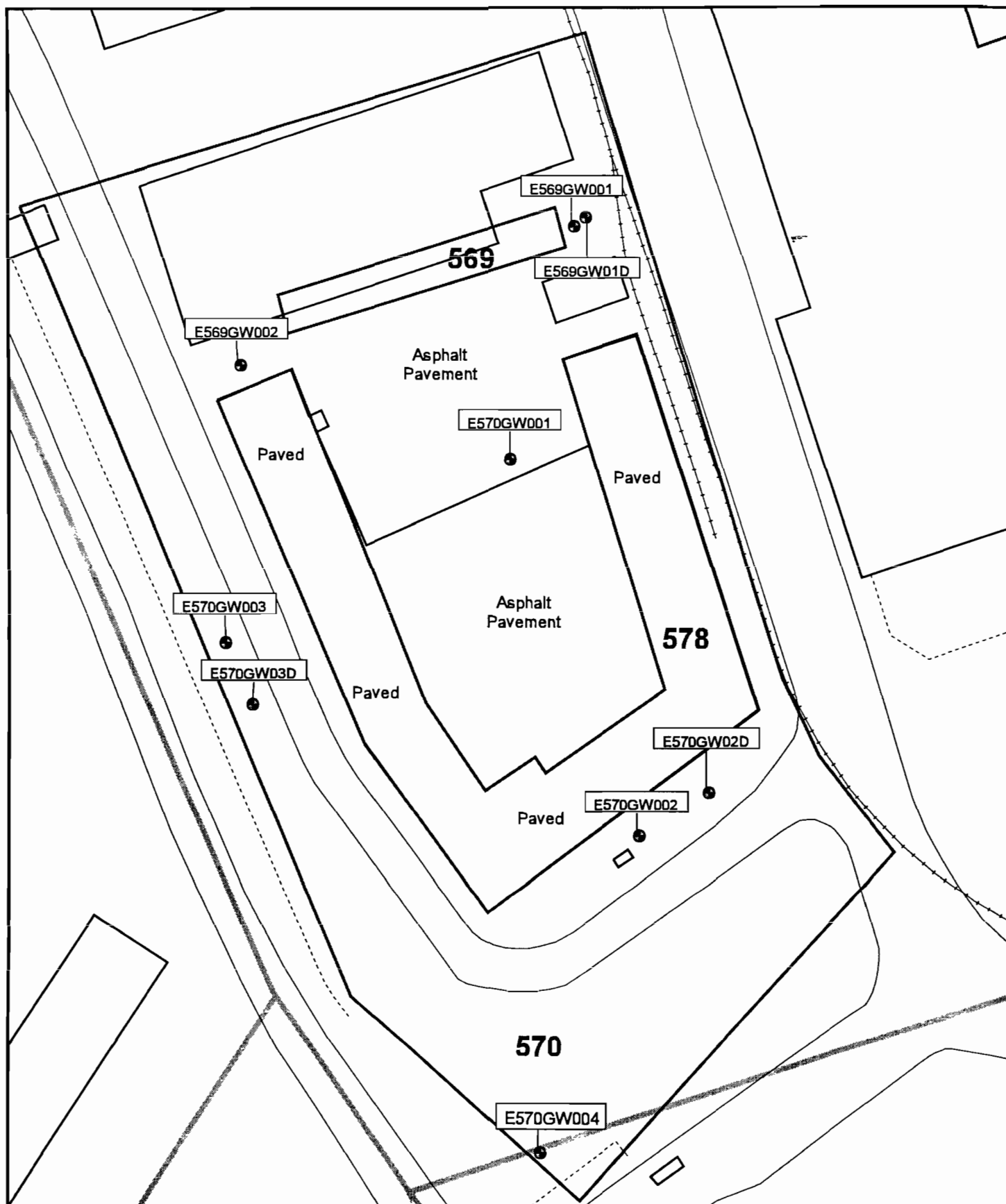


Figure 2-1
Historical Surface and Subsurface Sample Locations
AOC 569, AOC 570, and AOC 578, Zone E
Charleston Naval Complex



- Groundwater Well
- Fence
- Railroads
- Roads
- AOC Boundary
- SWMU Boundary
- Buildings
- Zone Boundary

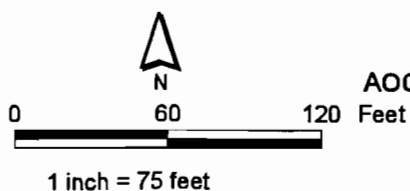


Figure 2-2
 Historical Groundwater Sample
 AOC 569, AOC 570, and AOC 578, Zone E
 Charleston Naval Complex

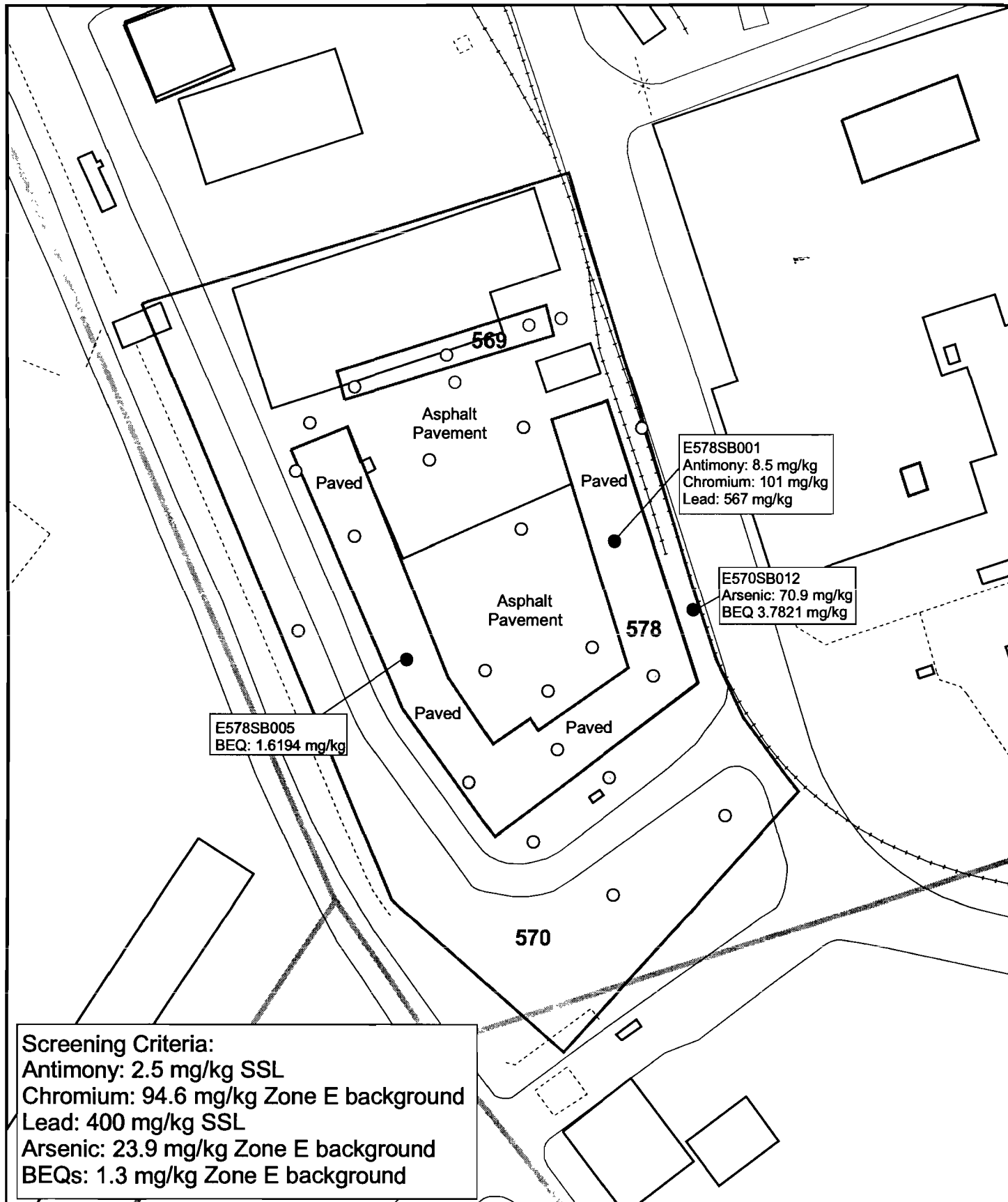
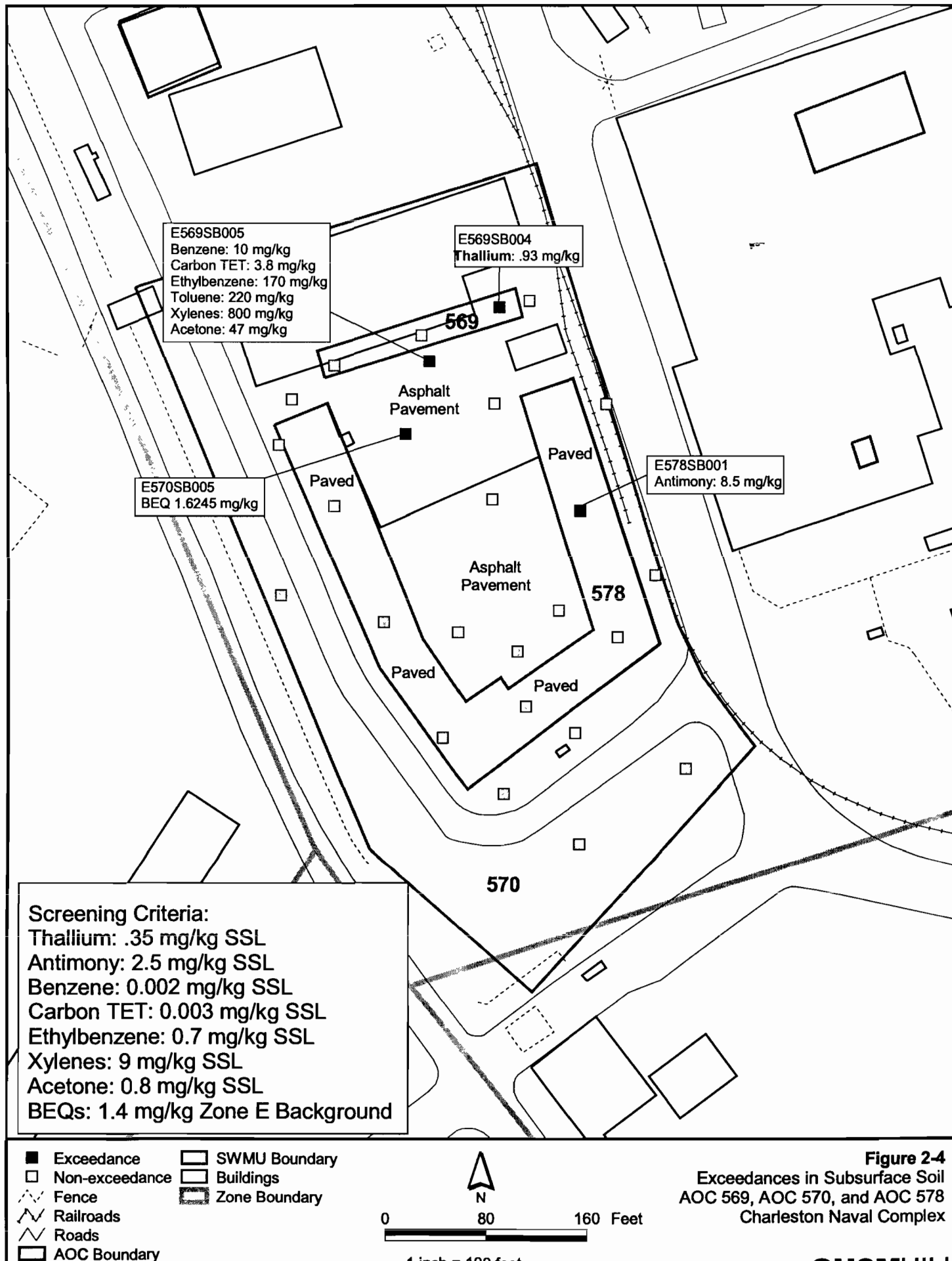


Figure 2-3
 Exceedance in Surface Soil
 AOC 569, AOC 570 and AOC 578
 Charleston Naval Complex



1 **3.0 Proposed Sampling and Analysis**

2 **3.1 Sampling Scope Summary**

3 **3.1.1 AOCs 569, 570, and 578**

4 Based on an evaluation of the data collected during the RFI and a comparison to COPC
5 screening criteria currently used by the Base Realignment and Closure Act (BRAC) Cleanup
6 Team (BCT), exceedances of the screening criteria for surface and subsurface soil were
7 identified at locations shown in Figures 2-3 and 2-4, respectively. In an effort to verify the
8 current concentrations of these site constituents, surface and subsurface soil samples at
9 some of these former RFI soil boring locations will be resampled as follows:

- 10 • E569SB005 will be resampled for BTEXs
- 11 • E569SB004 will be resampled for thallium
- 12 • E578SB001 will be resampled for antimony, chromium and lead

13 Proposed soil resampling locations are shown in Figure 3-1.

14 Two groundwater constituents—PCE and TCE—require further delineation. Figures 3-2 and
15 3-3 show historic detections of TCE and PCE, respectively, in groundwater wells in the
16 vicinity of the site. Figure 3-4 shows shallow groundwater elevation contours from water
17 level measurements conducted at the site during January 2002. Additional permanent
18 monitoring wells will be installed at the proposed locations shown in Figure 3-5, and
19 groundwater samples will be collected for VOC analyses from these new monitoring wells,
20 as well as selected existing wells, to evaluate the presence of VOCs in groundwater in the
21 vicinity of the site.

22 A full evaluation and presentation of the COPC screening against current criteria, as well as
23 a COPC/COC refinement analysis, will be provided in an RFI report addendum after
24 collection and analyses of the samples proposed herein.

25 **3.2 Sampling and Analysis Plan**

26 All investigative work will be performed in accordance with the Comprehensive Sampling
27 and Analysis Plan (CSAP) portion of the *Final Zone E RFI Work Plan, Revision 1*
28 (EnSafe/Allen & Hoshall, 1995).

Surface and Subsurface Soil

Surface and subsurface soil samples will be collected for laboratory analyses at the locations shown in Figure 3-1 to delineate the nature and extent of contamination. The analyses to be performed on these samples are also presented in Table 3-1.

The soil samples will be collected using hand augers and the sampling will be performed in accordance with the procedures outlined in the document *Environmental Services Division Standard Operating Procedures and Quality Assurance Manual* (ESDSOPQAM) (EPA, 1996).

For all sample locations, samples will be collected from the following depths:

- 0 to 1 ft bls (below any pavement present)
- 3 to 5 ft bls

Groundwater

Three existing shallow monitoring wells (E569GW001, E569GW002 and E570GW001) and one deep monitoring well (E570GW03D), which showed exceedances of VOCs during the initial RFI above their respective MCLs, will be re-sampled to verify current levels of VOCs.

Two new shallow monitoring wells and a new shallow/deep well pair will be installed and samples will be collected from these new wells in order to verify the presence of VOCs in the vicinity of the site. Recent measurements of groundwater elevations indicate that the average depth to water at the site is approximately 4 ft bls. Well screens will be set below the water table. Well installation requests for the proposed new monitoring wells will be made to the South Carolina Department of Health and Environmental Control (SCDHEC) under separate cover. Figure 3-5 shows the locations of existing and proposed new wells.

3.3 Health and Safety

CH2M-Jones places significant emphasis on the health and safety of our personnel, our subcontractors, and the local community. Once all personnel have arrived on site as part of the mobilization phase of the SAP, a project briefing and health and safety orientation meeting will be held. All work completed as part of this SAP will be performed in accordance with the CH2M-Jones Site-Specific Health and Safety Plan (CH2M-Jones, 2000).

Personnel working at the site will be required to comply with Level D personal protective equipment (PPE) requirements, as specified in the Health and Safety Plan.

3.4 Site Clearance

Soil boring locations will be marked or staked in the field using coordinates derived from the CNC Environmental Geographic Information System (EGIS) tool and utilizing the Global Positioning System (GPS) equipment. Table 3-2 shows the coordinates for the proposed new monitoring wells and soil sampling locations.

To prepare for the start of onsite operations, CH2M-Jones will notify the necessary agencies and departments regarding planned activities at the project site.

CH2M-Jones will examine the site for existing water, electrical, natural gas, telephone, and other utility lines that are potential hazards at the site. Utilities will be clearly marked and identified.

3.5 Waste Management and Disposal

Four waste streams will be generated as part of this SAP: pavement debris, soil cuttings, decontamination wastes, and used PPE. Soil cuttings will be drummed and characterized in accordance with South Carolina Hazardous Waste Management Regulations (SCDHEC R.61-79.261) and disposed in accordance with all applicable regulations and permits.

Decontamination wastes and used PPE will also be disposed in accordance with applicable regulations.

Pavement debris will be transported offsite for disposal. Offsite transportation and disposal will be performed by properly permitted and licensed subcontractors.

3.6 Equipment Decontamination

Decontamination of personnel, sampling and removal equipment, and materials will be in accordance with the CH2M-Jones Site-Specific Project Health and Safety Plan.

TABLE 3-1
 Analytical Summary for Supplemental Soil Sampling Activities
Sampling and Analysis Plan, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

New Sample ID	Number of Sample Locations	Analytes	Analytical Methods
Surface and Subsurface Soils – Nature and Extent			
E569SB004	1 location, with 2 depth intervals (0–1 ft bls, and 3–5 ft bls)	Total thallium	SW-846 6010
E569SB005	1 location with 2 depth intervals (0–1 ft bls, and 3–5 ft bls)	VOCs	SW-846 8260
E578SB001	1 location with 2 depth intervals (0–1 ft bls, and 3–5 ft bls)	Total antimony Total Chromium Total Lead	SW-846 6010
Groundwater			
Existing shallow monitor wells E569GW001 E569GW002 E570GW001	3 locations total	VOCs	SW-846 8260
Existing deep monitor well E570GW03D	1 location	VOCs	SW-846 8260
New shallow monitor wells: E569GW003 E569GW004 E569GW005 and new deep well E569GW05D	4 locations total	VOCs	SW-846 8260

TABLE 3-2

Coordinates for proposed sampling locations

Sampling and Analysis Plan, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

New Sample ID	Northing	Easting
Historic RFI Soil Borings to be Resampled		
E569SB004	375,537	2,316,772
E569SB005	375,492	2,316,714
E578SB001	375,374	2,316,836
New Groundwater Monitor Wells to be Installed, Developed and Sampled		
E569GW003	375,446	2,316,726
E569GW004	375,581	2,316,880
E569GW005	375,418	2,316,928
E569GW05D	375,413	2,316,931

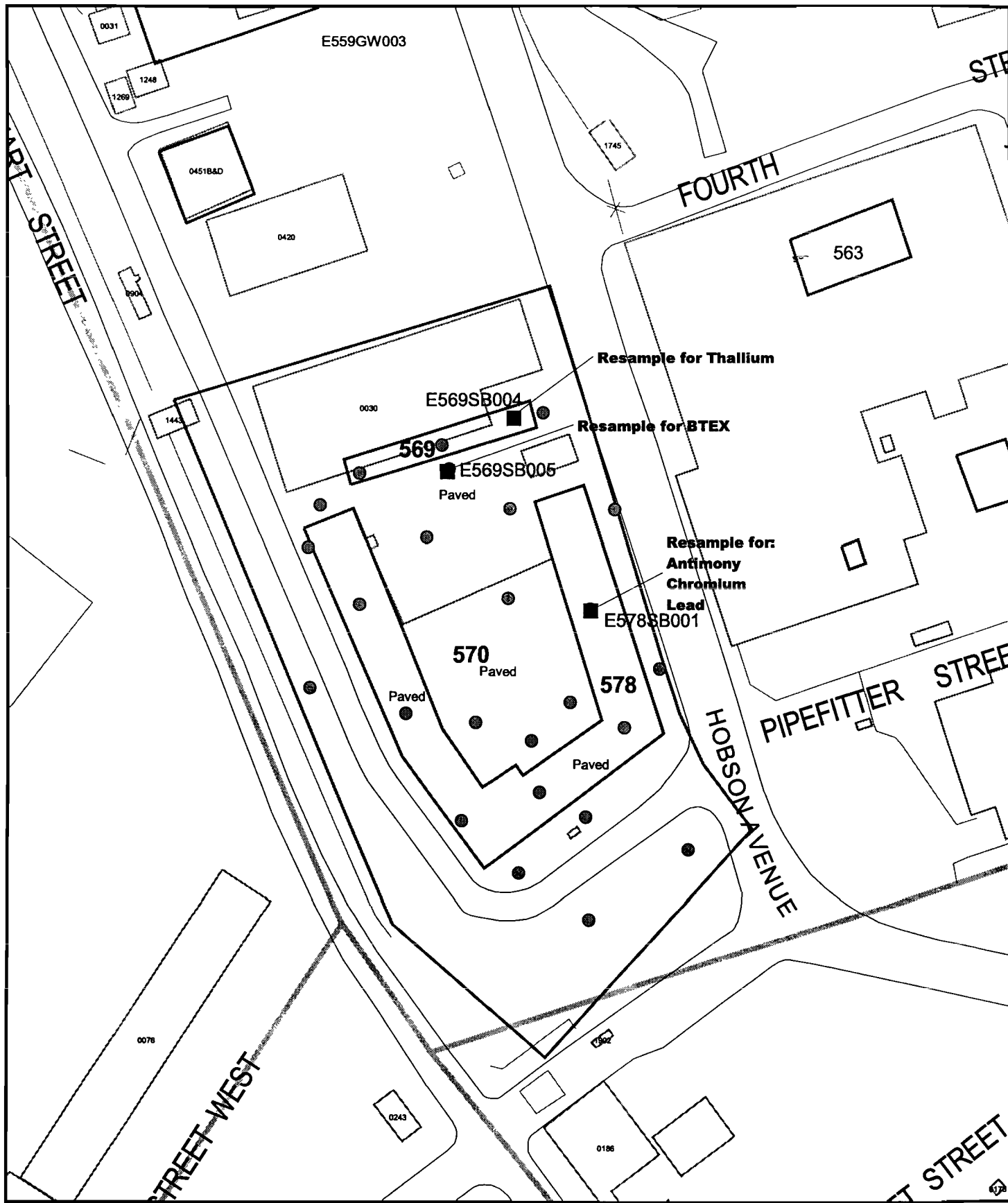


Figure 3-1
Proposed Soil Sampling Locations
AOC 569, AOC 570 and AOC 578
Charleston Naval Complex

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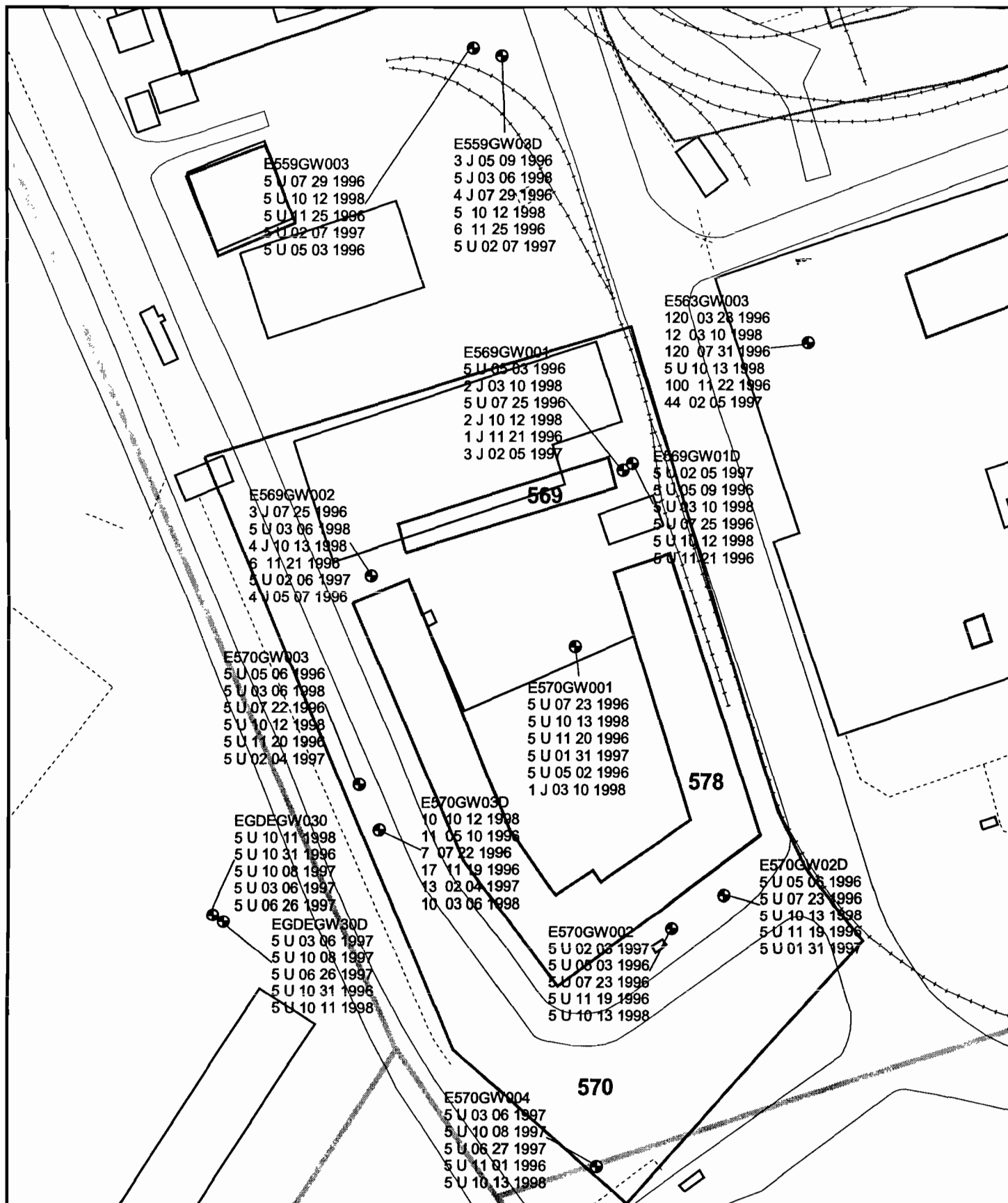


Figure 3-2
 Historic Groundwater TCE Exceedance
 AOC 569, AOC 570, and AOC 578, Zone E
 Charleston Naval Complex

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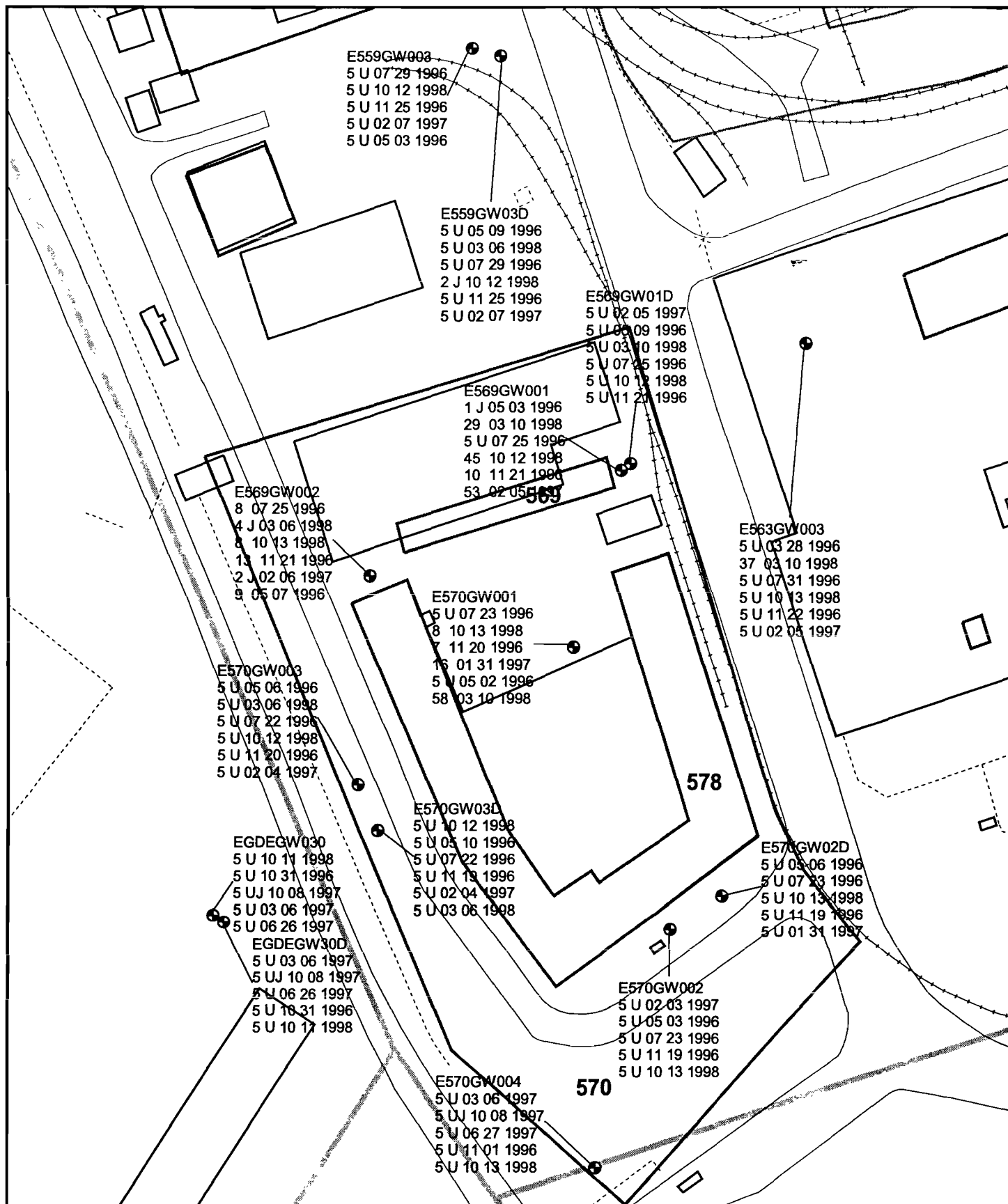
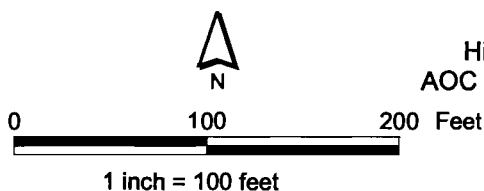
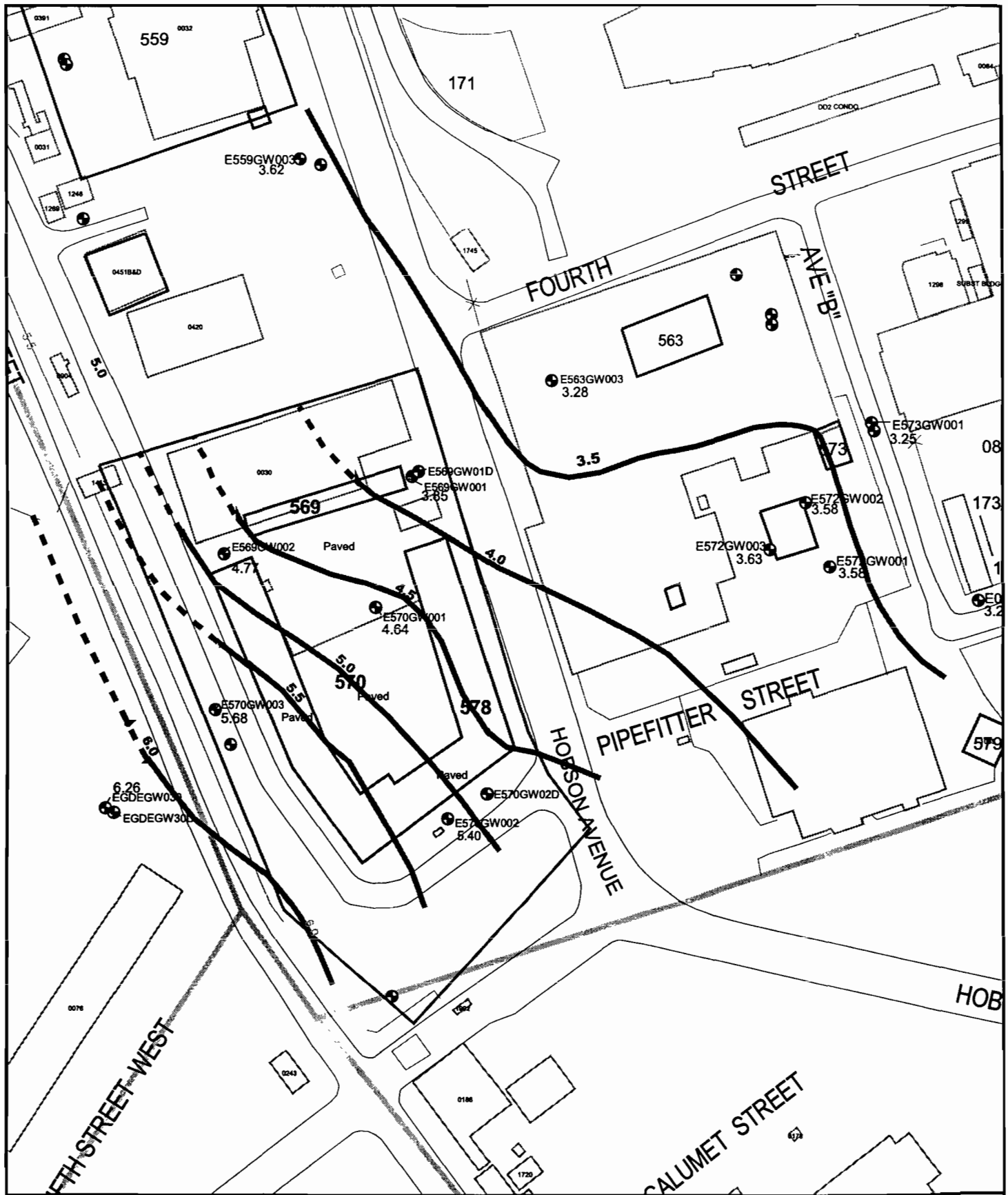


Figure 3-3
 Historic Groundwater PCE Exceedance
 AOC 569, AOC 570, and AOC 578, Zone E
 Charleston Naval Complex

Groundwater Sample
 Fence
 Railroads
 Roads
 AOC Boundary
 Buildings
 SWMU Boundary
 Zone Boundary
 Note: PCE Concentrations shown in ug/L





Shallow Groundwater Elevations (January 2002)
 Existing Monitoring Well with Groundwater Elevations
 3.28 in feet above mean sea level

Roads - Lines
 AOC Boundary
 SWMU Boundary
 Buildings
 Zone Boundary

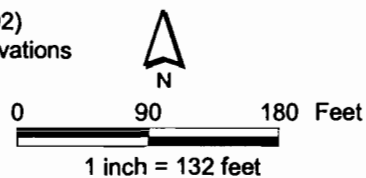


Figure 3-4
 Shallow Groundwater Potentiometric Map
 AOC 569, AOC 570 and AOC 578, Zone E
 Charleston Naval Complex

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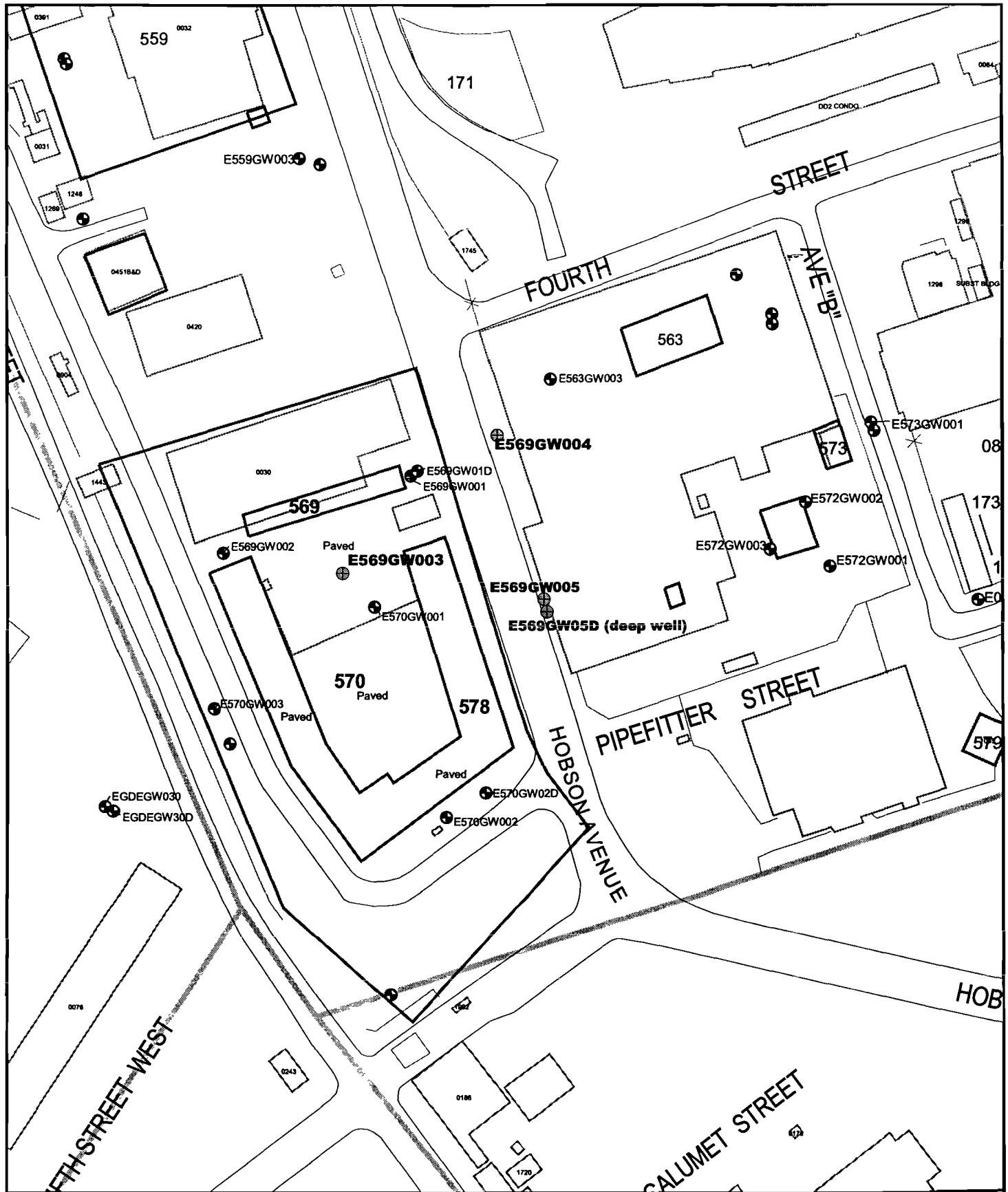
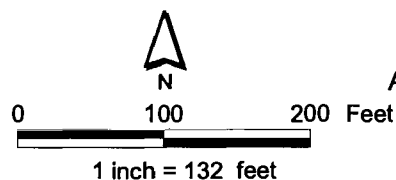


Figure 3-5
 Proposed New Monitor Well Locations
 AOC 569, AOC 570 and AOC 578, Zone E
 Charleston Naval Complex

Proposed Monitoring Well Location
 Existing Monitoring Well Location
 Roads - Lines
 AOC Boundary
 SWMU Boundary
 Buildings
 Zone Boundary



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1 4.0 References

- 2 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. November 1997.
- 3 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, Naval Base Charleston*. June
4 1995.
- 5 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, Naval Base Charleston*.
6 June 1995.
- 7 EnSafe Inc. *Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) Report*.
8 July 1995.
- 9 LandRec, Inc. for Landmark Construction Company. *Investigation of Underground*
10 *Contamination, Charleston Naval Shipyard – Building 1279, North Charleston, South Carolina*.
11 August 1992.
- 12 U.S. Environmental Protection Agency (EPA). *Environmental Services Division Standard*
13 *Operating Procedures and Quality Assurance Manual (ESDSOPQAM)*. 1996.